EASTMOUNT ENVIRONMENTAL SERVICES
Air Quality Specialists

Final Report

Chelsea-Sandwich, LLC
Bulk Terminal
Chelsea, Massachusetts

Emission Compliance Test Program

RTO, Residual Oil Loading Bays, Residual Oil Storage Tanks

Prepared for . . .

CAAssociates

Prepared by . . .

Eastmount Environmental Services, LLC
March, 2010
Project No. 09-040

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1.0 INTRODUCTION

1.1 General

Eastmount Environmental Services, LLC of Newburyport, MA and CAAssosiates of Acton, MA were retained by Chelsea-Sandwich, LLC (Cheslea-Sandwich) to conduct emissions compliance testing at their Chelsea, MA facility. The objective of the emissions test program was to demonstrate compliance with the following requirements set forth in Conditional Approval MBR-08-IND-007 issued by the Massachusetts Department of Environmental Protection (MassDEP):

- That the Adwest Regenerative Thermal Oxidizer (RTO) meets the overall 99.0% Destruction Efficiency (DE) for Volatile Organic Compounds (VOC)
- That the Adwest Regenerative Thermal Oxidizer (RTO) meets the overall 99.0% DE for Total Reduced Sulfur (TRS).
- That the capture system installed at the residual oil truck loading racks meets the required 90% capture efficiency
- That the capture system installed at the residual oil storage tank vents meets that required 95% capture efficiency.

The compliance testing requirements within MBR-08-IND-007 also requires "that the VOC concentration in the residual oil is determined for inclusion in the facilities SOMP". As a fossil fuel, residual oil is comprised of virtually 100 percent volatile organic compounds and testing was not needed to establish that fact. The composition may vary from shipment to shipment regarding to the exact proportions of individual organic compounds. However, there is not an established correlation between evaporative emissions and the infinite variations that could occur with complex chemical analysis.

Because there was no established correlation between liquid residual sample analysis and VOC emission calculations, the pretest protocol proposed that the inlet VOC results be used in conjunction with past inlet testing results to document the concentration of VOC is at or below the level used to calculate potential emissions (2,000 ppm as propane).

Testing occurred on February 4th, 2010. A summary of the primary parties involved in this test program as well as the applicable emission limitations are presented in Tables 1-1 and 1-2, respectively.

1.2 Program Overview

Eastmount conducted three inlet/outlet test runs in order to determine the overall DE of the RTO that controls emissions from the facility's residual oil storage tanks and the residual oil loading lanes of the loading rack. Each test run was comprised of the simultaneous inlet/outlet sampling to the control device for the determination of flow rate (scfm) and Total NonMethane Hydrocarbons (TNMHC in ppm and lb/hr).

In conjunction with these measurements, CAAssociates also took three sets of Tedlar bag samples at the inlet and the outlet of the RTO for TRS analysis to determine the DE of TRS

CAAssociates also demonstrated that the storage tanks and loading racks met the required capture efficiencies through flow and VOC measurements to confirm the design specifications of the capture systems.

1.3 Final Report Organization

The remainder of this Final Report is divided into five additional sections. Section 2 provides a summary of all test results, while Section 3 provides a detailed description of the RTO and facility operations. Section 4 presents a summary of the sampling locations to be utilized by the reference method. Section 5 provides a description of the flue gas monitoring methods, equipment and procedures. Section 6 addresses the quality assurance/quality control aspects of the program.

Table 1-1 Test Program Informational Summary

Source Information	
Facility Name:	Chelsea-Sandwich, LLC
Address:	11 Broadway Chelsea, MA 02150
Contact:	Mr. Jim Lally
Phone:	(617) 660-1100
Test Firm Information	
Test Organization:	Eastmount Environmental Services, LLC
Address:	65 Parker Street, Unit 3 Newburyport, MA 01950
Contact:	Mr. Andrew R. Seaha, QSTI
Phone:	(978) 499-9300
Regulatory Information	
Organization:	Massachusetts Department of Environmental Protection – Northeast Region
Address:	205B Lowell Street Wilmington, MA 01887
Contact:	Mr. Joseph Su
Phone:	(978) 694-3283
Consultant Information	
Consultant:	CAAssociates
Address:	16 Revolutionary Road Acton, MA 10720
Contact:	Mr. Paul Murphy
Phone:	(978) 263-4895

Table 1-2 Summary of Test Requirements

Source	Location	Parameters/Methods	Runs	Duration	Limits
RTO	Inlet	THC – 25A	3	60-min	99.0% DRE
		Sulfur - ASTM D5504-01		Extended Grab	
	Outlet	Flow – 1-4[1] THC – 25A CH_4 – 18	3	60-min	
		Sulfur - ASTM D5504-01		Extended Grab	
Tanks[3]	102, 103, 104, 106, 203, 204	Capture[2]	1	N/A	95%
Racks	G, H, J, K, L, M, N, O, P	Capture[2]	1	N/A	90%

1 Outlet fixed gases were determined on a real time basis in accordance with EPA Method 3A while outlet moistures were calculated utilizing a modified EPA Method 4 train.

2 The sources for which capture demonstrations were performed do not conform to industry norms upon which Method 204 was developed. Chelsea-Sandwich proposed an alternative method, as discussed in Section 4 of the pretest protocol (with approval), to accommodate the unusual process circumstances.

3 The permit lists Tank 202 as a Residual Oil tank. However, it has been switched to a distillate oil tank with no plans to return to residual oil service.

2.0 SUMMARY OF RESULTS

2.1 General

This test program was conducted on February 4, 2010. Testing on the RTO consisted of three one hour inlet/outlet test runs while all tanks and racks were being vented to the RTO. Each test run was comprised of simultaneous inlet/outlet sampling to the control device for the determination of flow rate (scfm), Total Hydrocarbons (ppm) and methane (ppm). In conjunction with the RTO testing, CAAssociates verified the Permanent Total Enclosure (PTE) requirements.

2.2 RTO Test Results

The RTO testing determined that the unit is in full compliance with the permitted emission limit of 99% DRE. The three-run test average for the RTO was 99.43% DRE. A summary of the individual test runs are presented in Table 2-1 below, while all supporting data is included in Appendix A and B.

Table 2-1 Summary of Test Results – RTO

Global Oil - RTO DRE					
		Run No.			Test
Parameter	Units	1	2	3	Average
Date	MM/DD/YY	4-Feb-10	4-Feb-10	4-Feb-10	-
Start Time	HH:MM	6:45	8:05	9:25	-
Stop Time	HH:MM	7:45	9:05	10:25	-
Inlet -- RTO					
THC (as propne)	ppm (wet)	827.7	865.7	861.5	851.6
Flow	wscfm	6,675	6,906	6,690	6757
Run length	minutes	60	60	60	60
THC	lb/hr	37.9	41.0	39.6	39.5
Outlet -- RTO					
THC (as propane)	ppm (wet)	5.2	5.8	6.8	5.9
CH4	ppm (wet)	2.5	3.2	3.1	2.9
Flow	wscfm	6,675	6,906	6,690	6757
Run length	minutes	60	60	60	60
THC	lb/hr	0.24	0.28	0.31	0.28
Methane	lb/hr	0.04	0.05	0.05	0.05
non-methane VOC's	lb/hr	0.20	0.22	0.26	0.23
Compliance Summary					
THC DRE (by run)	%	99.48%	99.46%	99.34%	
THC DRE (average)	%		**99.43%**		
MassDEP Limit	%		**99.0%**		
DRE Status =	**Pass**				

2.3 Tank Capture Results

A summary of the individual tank capture hoods is provided in Table 2-2 below, while all supporting data is included in Appendix A.

Table 2-2 Summary of Result – Tank Capture

Tank	Flow Rate (DSCFM)	Hood VOC	Intake VOC
203	513	1300	0
204	599	2200	0
102	496	350	0
103	507	1000	0
104	474	350	0
106	486	350	0

2.4 Rack Capture Results

A summary of the individual tank capture hoods is provided in Table 2-3 below, while all supporting data is included in Appendix A. VOC measurements at selected racks during truck loading indicated that the VOC concentration in the tank showed an average 2,000 ppm, while the concentration around the opening measured 100 ppm on average.

Table 2-3 Summary of Results - Rack Capture

Rack	Flow Rate (DSCFM)
G	333
H	343
J	371
K	305
L	346
M	288
N	329
O	372
P	406
R	405

2.5 TRS Results

Samples of TRS indicated that the inlet results, as well as the outlet results were below the method detection level of 5 ppb (some compounds have a detection level of 2.5 ppb). A second set of TRS samples was taken with similar results. Summaries of TRS results are provided in Appendix A and B.

3.0 PROCESS DESCRIPTION

3.1 Facility Description

The Chelsea-Sandwich LLC facility is located at 11 Broadway in Chelsea, MA. This facility handles distillate and residual oil products. The facility receives petroleum products by ship or barge into onsite storage tanks and then loads over-the-highway trucks and barges from their storage tanks.

3.2 Source Description

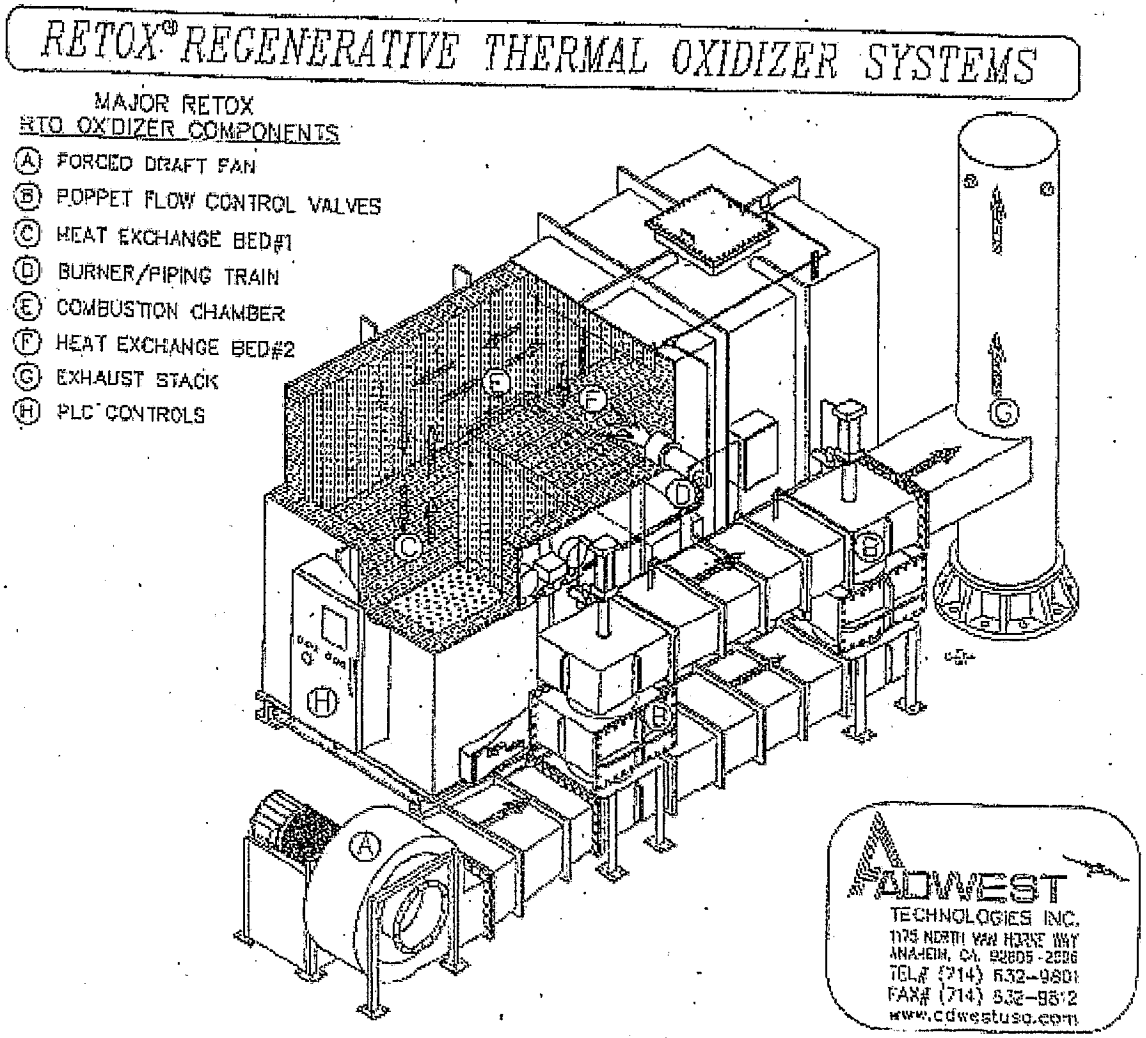
The subject source consists of the areas of the facility that store and deliver residual fuel oil. The emission units associated with storage, as identified in the Conditional Approval, include EU4-102, EU5-103, EU6-104, EU8-106, EU19-202, EU20-203 and EU21-204, which correspond to tanks 102, 103, 104, 106, 202, 203, and 204, respectively. (Note the Tank 202 has been switched distillate oil service with no plan for returning to residual oil service.) The emission units associated with delivery include EU25, but only those bays used to delivery residual oil. The residual oil bays include bays G, H, J, K, L, M, N, O and P. A capture system has been installed at each tank and loading rack in No 6 fuel oil service. The capture system delivers vapors from working and breathing losses to a regenerative thermal oxidizer (RTO) for control. A brief description of each aspect of the control system is provided below.

3.2.1 RTO

Chelsea-Sandwich LLC installed a regenerative thermal oxidizer (RTO) with maximum design flow capacity of 9,000 scfm to destruct the VOC and TRS emissions from the evaporative losses associated with the residual oil storage tanks and the residual oil truck loading operations. A diagram of the unit is provided in Figure 2-1. The vendor performance guarantee for the RTO is 99% destruction efficiency of VOC and TRS operating at a minimum chamber temperature of 1,500 F (design residence time is 1.0 second).

Emissions captured for control by the proposed RTO included those from the residual oil storage tanks and the residual oil truck loading. These sources contain the majority of TRS, which make them the target of the odor control strategy. The following describe the emission collection system for the two source types.

Figure 3-1 RTO Schematic



3.2.2 Tank Vents

The capture system for the residual oil storage tanks is an exhaust system that originally planned to maintain a constant draw of up to 850 cfm. The basis for the design flow rate is to handle the displaced air from the tank headspace during a filling operation that has a maximum pump rate of a ship (9,000 barrels/hour). However, upon review, it was determined that virtually all residual oil is received by barge with a maximum pump rate of 6,000 barrels/hour which equates to a needed draw of 560 cfm. (In the event the terminal receives a load of residual oil from a ship off loading at a rate greater than 6,000 barrels/hour, the product will be pumped to two storage tanks simultaneously.)

During times when the tank is not filling, the capture system will maintain a constant exhaust rate in order to capture vapor displacement associated with other operations, such as tank-to-tank transfers, air sparging and any breathing emissions associated with the residual oil tanks. The exhaust system features a hood design that fits over each tank's vent such that any portion of the exhaust rate that is not from the tank displacement will come from intake of fresh air. The purpose of the hood design is to assure that the tank is always stabilized to atmospheric pressure in order to meet petroleum tank safety requirements that assure tanks do not distort due to overpressure or collapse due to vacuum. The capture efficiency rating by the design engineer is minimally 95%.

3.2.3 Truck Loading

The capture system for the residual oil truck loading is a flex hose arrangement that maintains a constant draw of up to 300 cfm from each loading lane. The use of flex hose is necessitated to enable effective use for the different truck heights that may load at the rack. Additionally, the residual loading is accomplished by a top-loading arm that goes down into the truck hatch. The flex hose is positioned by the operator beside the loading arm. The flex hose cannot have a tight connection, as it is necessary for the operator to view the oil level in the truck to eliminate any risk of overflow spillage. Because the truck has varying diameter hatches the capture efficiency rating by the design engineer is 90%.

4.0 SAMPLING LOCATIONS

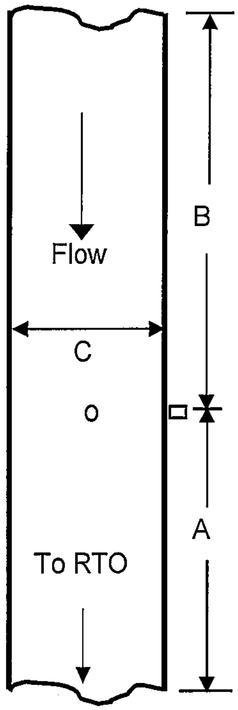
4.1 RTO – Inlet

Inlet gases are directed from the storage tanks and loading racks to the RTO via a series of trunks. Inlet sampling was conducted following the convergence of all trunks. THC sampling took place prior to the RTO's mist eliminator filter system and was placed in the centroidal area of the stack. The inlet location has an inside diameter of 26". The port locations do not meet EPA Method 1 criteria. Because of this, flow measurements were not conducted at the inlet and flow rates from the outlet were applied to both the inlet and outlet locations, as stated in the approved pretest protocol. A schematic detailing all sampling points is presented in Figure 4-1.

4.2 RTO - Outlet

Outlet gases from the RTO are directed to a circular (24") vertical exhaust stack. The two ports are located 90° from each other and meet the minimum EPA Method 1 criteria. The ports are located at a minimum of 2.0 equivalent diameters downstream and 0.5 equivalent diameters upstream from the closest bend or expected pollutant concentration change. A schematic detailing all sampling points is presented in Figure 4-2.

Figure 4-1 RTO - Inlet Sampling Configuration

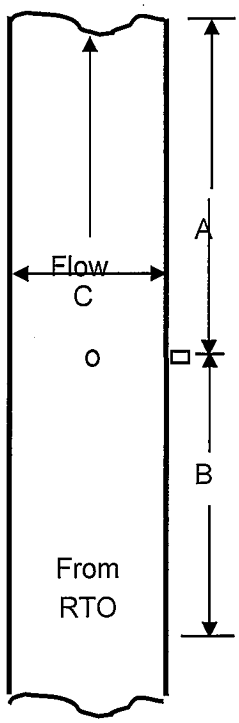


Stack Configuration		
Description	**Distance**	**Equivalent Diameters**
Upstream (A)	n/a	n/a
Downstream (B)	n/a	n/a
Diameter (C)	26"	n/a
Number Of Ports	2	n/a
Flow Traverse Points (per diameter)		
Traverse Points	**% of diameter**	**Distance (inches)**
No flow was measured at the inlet location		

THC Sampling Points:

- **THC was sampled at a single point within the centroidal area of the stack during each test run.**

Figure 4-2 RTO - Outlet Sampling Configuration



Stack Configuration		
Description	**Distance**	**Equivalent Diameters**
Upstream (A)	> 12"	> 0.5
Downstream (B)	> 48"	> 2.0
Diameter (C)	24"	NA
Number Of Ports	2	NA
Flow Traverse Points (per diameter)		
Traverse Points	**% of diameter**	**Distance (inches)**
1	4.4	1.1
2	14.6	3.5
3	29.6	7.1
4	70.4	16.9
5	85.4	20.5
6	95.6	22.9

THC Sampling Points:

- **THC was sampled at a single point within the centroidal area of the stack during each test run.**
- **Moisture was determined by utilizing a midget moisture train from a single point in the centroidal area of the stack.**
- **Methane was analyzed from the outlet location only.**

5.0 TEST PROCEDURES

5.1 Overview

The Adwest RTO at Chelsea-Sandwich was tested in order to determine the units' compliance status with respect to the facility's air permit as set forth by the Commonwealth of Massachusetts Department of Environmental Protection within Conditional Approval MBR-08-IND-007. Each pollutant parameter was tested in strict accordance with official EPA procedures at the sampling locations previously described. This section details the test procedures that were used during this test program.

5.2 Methodology

5.2.1 Non-Methane Hydrocarbons – EPA Methods 25A and 18

Total Hydrocarbons were measured at the inlet and outlet test locations while methane was analyzed at only the RTO outlet. Methane was assumed to be zero at the inlet location as there is no gas firing prior to this point.

Total hydrocarbons (THC) was determined in accordance with EPA Method 25A. Eastmount met the requirements of Method 25A by utilizing two TECO Model 51 Flame Ionization Detector (FID) analyzers as well as a VIG Industries 200 analyzer (methane only). All analyzers were calibrated with certified propane in air standards. The inlet was operated on a 0-10,000 ppm range and the outlet was operated on a 0-1,000 ppm range. The analyzers were calibrated prior to and following each test run to ensure the accuracy of the test data.

The methane concentration were determined in accordance with EPA reference Method 18, *Measurement of Gaseous Organic Compound Emissions by Gas Chromatography*. Eastmount used a VIG Industries Model 200 Duel Channel FID with an internal gas chromatograph (GC) column to determine methane concentrations. The system was calibrated using three certified standards of methane introduced to the analyzer that generated a curve around the expected flue gas concentrations. Inside the analyzer itself, sample is split and delivered to both the GC column and the FID that measures total hydrocarbons. The sample was taken from a Tedlar bag that was filled during the course of the one hour test run. Due to the RTO bed switching spike, a single bag was collected in order to properly quantify total methane emissions, as opposed to continuous GC injections once every 3 minutes that might miss methane spikes.

Non-methane hydrocarbons were determined by subtracting the methane value from the THC value at each test location during each test run. Destruction removal efficiency was based off of the total non-methane hydrocarbon mass emission rates at the respective test locations.

5.2.2 Capture Demonstration

- **Truck Loading** – Based on the recommended design criteria, Chelsea-Sandwich demonstrated that the static pressure in the plenum used to exhaust the loading rack was maintained at a minimum vacuum of 8 inches of water column. A velocity measurement (and calculated flow) was performed in the common header as a means to establish a correlation to the static pressure. Because each loading lane exhaust is connected to the common header, the flow of each was one ninth of the total flow. Because the 90% capture design is based on 300 cfm per lane, the compliance test verified that the total flow from the loading rack header is at least 2,700 cfm. Future flow verification will use the output of the pressure gauge rather than the face velocity requirement listed in MBR-08-IND-007, Table 3.

- **Tank Vents** – Based on the recommended design criteria, Chelsea-Sandwich demonstrated that the static pressure in the plenum used to exhaust each tank was maintained at a minimum vacuum of 5 inches of water column. During the compliance test, velocity measurements (and calculated flow rates) were performed on each tank's emission collection line and correlated to a pressure reading. Because the 95% capture is based on 560 cfm per tank, the compliance test verified that the flow of each tank's line is at least 560 cfm. Future flow verification will use the output of a pressure gauge rather than the face velocity requirement listed in MBR-08-IND-007, Table 3.

  To supplement the static pressure measurement, the capture efficiency was evaluated using a hand-held organic vapor analyzer (Photovac MicroFID) in two key points in the hood. The first point to be tested was the fresh air intake of the hood. The second point was in the headspace of the hood, just prior to the exit duct that feeds the RTO. Capture efficiency was verified based on the ratio of the THC concentration at the fresh air intake to that of the exit duct.

In addition to the verification of the duct static pressure, Chelsea-Sandwich developed a Standard Operating and Maintenance Procedure (SOMP) to ensure that the exhaust system is operational.

5.3 Description of THC and Methane Sampling

5.3.1 Total Hydrocarbon and Methane Sampling System

What follows is a description of the transportable continuous emissions monitor system used to quantify total hydrocarbon emissions. The system meets all the specifications of Reference Method 18 and 25A:

- **Probe -** A single opening stainless steel probe with an in-stack sintered filter was used at each sample location. The probe was of sufficient length to reach the centroidal area of the respective sample locations.

- **Calibration Tee** - Stainless steel tee (3/8") located between the probe and the filter that allow the operator to inject calibration gas through the entire sampling system. Excess calibration gas exited the probe eliminating any potential over pressurization.

- **Sample Line -** A heated 3/8" OD Teflon sample line was used to transport the sample stream from the test locations to the analyzers. The lines were heated to approximately 300°F to prevent condensation of hydrocarbons before reaching the analyzer.

- **System Calibration Line -** A ¼" OD Teflon tube was used to transfer calibration gas from the cylinder to the calibration valve.

- **Sample Pump** - A leak-free pump was used to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. The components of the pump that contact the gas stream are constructed of stainless steel or Teflon. The sample pump was heated to prevent condensation.

- **Sample gas manifold** – A heated Teflon manifold allowed distribution of inlet and outlet samples to respective analyzers. The manifold is equipped with sample pressure gauges, thermometer, heater, and Teflon components. It also allows distribution to other instruments or measurement sources such as a gas chromatograph or Tedlar bag. When filling bags, a rotameter allows the flow rate to be visually adjusted.

- **VOC Analyzer** – Two Teco Model 51 flame ionization analyzers (FIA) were used to measure THC at both the inlet and outlet locations, while outlet concentrations of methane were measured by utilizing a VIG Industries Model 200 FIA.

- **Data Acquisition -** The FIA's response were recorded on a Dell Vostro 1710, 1.60 GHz computer working in unison with an Iotech Data Acquisition System (Personnel Daq 55/56). This system is programmed to collect data once every 2 seconds, while reporting 1-minute averages. This software operates in a Windows environment.

5.3.2 Total Hydrocarbon and Methane Sampling Procedures

The FIAs were calibrated prior to sampling using zero, low, mid and high calibration gases of certified cylinders of propane in a balance of air. Calibrations were conducted through the entire sample system. A description of the specific procedures is provided below:

- **Zero:** The zero point of the analyzer was determined using a pre-purified cylinder of air. The zero point was analyzed for a minimum of five minutes to monitor drift before sampling commences.

- **Low:** The low calibration gas was 25-35% of span. It was introduced to the sample system and the response of the analyzer was recorded.

- **Mid:** The mid calibration gas was 45-55% of span. It was introduced to the sample system and the response of the analyzer was recorded.

- **High:** The high calibration gas was 80-90% of span. It was introduced to the sample system and the response of the analyzer was adjusted accordingly.

Once the analyzers were calibrated, the system calibration valve was switched to sample mode and sampling commenced. The response time of the system was determined from the time the valve was actuated to the time the response of the FIA is 95% of the steady state sample value. The DAS then recorded the analyzer response throughout the test run. Following the test run, the sampling system was post calibrated. The post calibration consisted of delivering zero and a representative upscale calibration point through the entire sampling system and recording the system response. This response was used in conjunction with the initial system calibration in order to determine calibration drift over the test run period.

5.4 Reference Method Volumetric Flow Determination

In conjunction with each outlet CEMS monitoring run, Eastmount conduct a moisture sample and a flow traverse in accordance with EPA Methods 1-4, 40CFR60, Appendix A. The design specifications for this train meet all the criteria of EPA's Reference Method 1-4 as found in the Federal Regulations under Section 40CFR60 Appendix A, as amended. The following is a description of the individual components that comprised the sampling train.

5.4.1 Velocity and Temperature Profile

Eastmount conducted volumetric flowrate determinations during this test program in accordance with procedures delineated in EPA Methods 1 and 2, 40CFR60, Appendix A. The system components necessary to conduct this testing are detailed below.

- **Pitot Tube** – An S-type pitot tube was used to measure all gas velocities. The pitot tube met all of the dimensional criteria set forth in Method 2, therefore a coefficient of 0.84 was used.
- **Pitot Lines** - The pitot tube was connected to a manometer via leak free Tygon and teflon tubing.
- **Manometer** - An inclined manometer capable of measuring ten inches of water column pressure drop was used.
- **Thermocouple** - A "K" type thermocouple was used to monitor the stack temperature at each traverse point.
- **Cyclonic Flow Check** – One cyclonic flow measurement was conducted prior to any compliance testing. This was performed by rotating the pitot tube perpendicular to the direction of the flow, and reading the angle. The stack gas at the outlet to the RTO was found to have less than 20° cyclonic angle, resulting in an acceptable flow measurement location.
- **Static Pressure** – One static pressure measurement was conducted during each test run by rotating the pitot tubes perpendicular to the direction of flow, disconnecting the negative pitot (if positive) and recording the deflection of the manometer.
- **Barometric Pressure** - The barometric pressure will be determined on-site using an aneroid barometer that was previously calibrated at Eastmount's laboratory using a NIST traceable mercury barometer.
- **Gas Molecular Weight Determination** - The O_2 and CO_2 content of the sample gas will be measured in accordance with EPA Method 3 and 3A (method 3 for the inlet and 3A for the outlet) or equivalent, 40CFR60, Appendix A.

5.4.2 Moisture Determination

Eastmount conducted one moisture approximation determination during each test run at the outlet test location only. Eastmount conducted an Alternative Moisture Measurement Method (Midget Impingers) allowed under Method 4 (for locations >200 degrees F). A synopsis of the procedure is presented below.

1. **Sample Train Preparation** – Sample train preparation consisted of the following:
   - Placed 15ml of deionized water in each of the first 2 midget impingers.
   - Left the third impinger empty
   - Placed approximately 15 grams of silica gel in the fourth impinger.
   - Recorded initial volumes and weights on the field data for each impinger.
   - Assembled the entire sampling train.
2. **Pre-Test Leak Check** - The system was leak checked by disconnecting the first impinger from the probe and, while blocking the impinger inlet and activating the pump. An acceptable leak check is achieved when the rotometer indicates no flow and bubbling is limited to 1 bubble per second.
3. **Sampling** – A personal sampling pump was used to collect a sample at approximately 1 liter/minute throughout the duration of each test run. The sample gas volume was determined by the personal sampling pump operating type in conjunction with the pumps calibrated collection rate.
4. **Post-Test Leak Check** - Upon completion of each test run, the system was leak checked as described in Item 2.
5. **Sample Recovery** - The impingers were then be recovered quantitatively for determination of net condensate gain.

5.5 Total Reduced Sulfur

In conjunction with each CEMS monitoring run, CAAssociates collected Tedlar bag samples for TRS. Samples were analyzed in accordance with ASTM D5504-01. To conform to the method's rigorous holding time criteria, these samples were analyzed within 24 hours of collection.

5.5.1 TRS Sampling System

CAAssociates filled Tedlar bags with a slipstream of the inlet and out locations using an evacuated lung assembly in accordance with procedures delineated in EPA Method 18 as delineated in 40CFR60, Appendix A. The system components necessary to conduct this testing are detailed below.

- **Probe -** A single opening Teflon probe was used at each sample location. The probe was of sufficient length to reach the centroidal area of the respective sample locations.
- **Tedlar Bags -** The samples bags were constructed of a chemically inert substance to reduce influence of the material on the concentration of the pollutants in the sample. Each bag was equipped with a valve that, when open, which allowed the bag to be filled and/or purged. Bag volumes were either 1 liter, 3 liter or 5 liter.
- **Evacuated Lung** – A leak-free chamber with valving system that allowed the creation of a vacuum inside the chamber.
- **Pump** – A pump was used to create the vacuum in the evacuated lung. The pump pulled air that is inside the chamber surrounding the Tedlar bag and dumped it outside the chamber. This allowed sample air from the duct to replace the volume removed by the pump by filling the bag. The pump was equipped with a flow regulator to allow an integrated bag sample to be pulled over a period of time. A Gillian personnel sampling pump was used.
- **Stop watch –** For measuring the averaging period of the sample.

5.5.2 TRS Sampling Procedures

To ensure that the minimum holding time criteria was met, all samples were taken in the afternoon. All bags were new and unused to ensure sample integrity.

- **Sample Train Assembly** - To begin the sampling event, the bag was loading into the chamber of the evacuated lung assembly. A fresh probe consisting of ¼ inch Teflon tubing was placed in the duct and connected to the evacuated lung assembly. The Tedlar bag was then loaded into the evacuated lung and the pump connected to the lung assembly.
- **Sample Purge –** With the Tedlar bag closed, the probe was purged to flush the internal volume of the probe with sample.
- **Sampling** – Once the probe was purged, sampling commenced. The bag was opened to the sample line and the pump turned on to evacuate the chamber. As the chamber air is removed, sample fills the Tadlar bag to replace the volume.
- **Analysis** – When the sampling run was completed, each bag was labeled with the name of the facility, location, date, time and required analysis. Samples were analyzed for total reduced sulfur in accordance with ASTM D5504-01.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

6.1 Overview

Sampling was conducted by trained personnel with extensive experience in Reference Method sampling. All sampling and analysis was conducted in strict accordance with EPA test procedures. The quality control procedures found in the EPA Quality Assurance Handbook for Air Pollution Measurement Systems were adhered to as well.

All calculations were conducted in strict accordance with the equations found in the individual Methods. Emission rate calculations were conducted on a computer and the input data was checked by a person other than the original calculator to ensure that it is correct.

Strict QA/QC protocols were followed during all phases of this project. These protocols include:

- QA objectives for measurement data;
- Data reduction;
- Internal QC;
- Calibration of equipment;
- Corrective action, if necessary; and
- Use of standardized field data sheets.

These specific procedures in addition to Eastmount's usual high standard of quality control helped validate the results obtained in this test program. Eastmount is staffed by a team of qualified and experienced environmental professionals. As the majority of our emissions testing work is done for compliance purposes, strict QC procedures are incorporated into our everyday work performance.

6.2 Equipment Calibrations

Eastmount's pitot tubes, thermocouples and barometers are maintained in accordance with specifications set forth in EPA "Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III Stationary Source Specific Methods" and with manufacturer's suggested procedures. A summary is presented below:

- **Balance** - All analytical balances are calibrated against Class M weights. A daily onsite check is also conducted using a Class S weight.

- **Thermocouples** - All type K thermocouples are calibrated against ASTM mercury in glass thermometers at two points. The first point is in an ice bath and the second at the boiling point of water.

- **Pitot Tubes** - All standard and Type "S" stainless steel pitot tubes are designed to meet the dimensional criteria set forth in Method 2, therefore a coefficient of 0.99 (standard) or 0.84 (Type "S") is used.